Fishery Data Series No. 99-22

Age and Length Composition of Arctic Grayling in Mendeltna Creek Based Upon Hook-and-Line and Electrofishing Catches During 1998

by
James T. Fish

September 1999

Alaska Department of Fish and Game **Division of Sport Fish**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition. All others must be defined in the text at first mention, as well as in the titles or footnotes of tables and in figures or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
metric ton	mt
milliliter	ml
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
ounce	oz
pound	lb
quart	qt
yard	yd

Spell out acre and ton.

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour (spell out for 24-hour clock)	h
minute	min
second	s

Spell out year, month, and week.

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.
All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.
and	&
at	@
Compass directions:	
east	E
north	N
south	S
west	W
Copyright	©
Corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
et alii (and other people)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.,
id est (that is)	i.e.,
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
number (before a number)	# (e.g., #10)
pounds (after a number)	# (e.g., 10#)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)

Mathematics, statistics, fisheries

alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, χ^2, etc.
confidence interval	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	Var

FISHERY DATA SERIES NO. 99-22

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by

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ABSTRACT

Age and length composition of Arctic grayling in Mendeltna Creek were estimated based upon hook-and-line and electrofishing catches during late spring and mid-summer, 1998. Data indicated that age-3 were caught in the greatest proportion during both May ($p = 0.52$, SE = 0.06) and July ($p = 0.52$, SE = 0.03). However, fish ≥ age-4 were caught in greater proportions during May ($p = 0.35$, SE = 0.06) than during July ($p = 0.05$, SE = 0.01), whereas fish ≤ age-2 were caught in greater proportions during July ($p = 0.43$, SE = 0.03) than during May ($p = 0.13$, SE = 0.04). Overall, larger (mean length = 235 mm FL, SD = 41.9) and older (maximum age of 9 years) fish were caught during late May, whereas smaller (mean length = 213 mm FL, SD = 37.6) and younger (maximum age of 6 years) fish were present during July. Interviews from seven anglers encountered during 1998 sampling activities suggest that a spring fishery does not occur on Mendeltna Creek. It is hypothesized that many adult Arctic grayling may enter Mendeltna Creek during early spring to spawn, and later emigrate to summer feeding locations outside Mendeltna Creek. Anglers probably target remaining Arctic grayling at two access locations on Mendeltna Creek throughout the summer and into the fall.

Key Words: Arctic grayling, *Thymallus arcticus*, Mendeltna Creek, Tazlina River drainage, length composition, age composition, gear selectivity

INTRODUCTION

Mendeltna Creek, located in the Tazlina River drainage, is approximately 36.8 km (23 mi) in length, and runs from Old Man Lake and Mendeltna Springs into Tazlina Lake. It is crossed by the Glenn Highway approximately 55.4 km (34.2 mi) west of Glennallen. Mendeltna Creek is accessed at the Glenn Highway Bridge and upstream by Lake Louise Road (approximately 43.2 km from Glennallen), which, after 9.6 km, connects to Oilwell Road (Figure 1). Access via Oilwell Road provides angling opportunity on Mendeltna Creek, where anglers can walk approximately 3.2 km upstream to Old Man Lake or float downstream approximately 11.2 km to the Glenn Highway Bridge.

Mendeltna Creek has been identified as supporting recreational fisheries for Arctic grayling, rainbow trout, and occasionally Dolly Varden (ADF&G, *Unpublished*). The Arctic grayling sport fishery increased in popularity during the early 1990s; an approximate 10-fold increase in harvest of Arctic grayling (102 to 1,041 fish) was estimated from 1991 to 1995, according to the Statewide Harvest Survey (Howe et al. 1995, 1996, and 1997 and Mills 1991, 1992, 1993, and 1994). Between 1992 and 1996, an average of 702 Arctic grayling were harvested annually from Mendeltna Creek (see Figure 2). Estimated harvest of Arctic grayling during 1997 was reported at 337 fish (Howe et al. 1998).

This fishery was thought to occur during late spring, where presumably post-spawning fish migrating downstream from Old Man Lake outlet were harvested, before anglers begin to concentrate their efforts on catching king salmon (T. Taube, Alaska Department of Fish and Game, Glennallen, personal communication). However, Arctic grayling may also be entering the creek during this time, and moving either upstream or downstream, to utilize summer feeding habitat. Little is known concerning the life history patterns and seasonal distributions of Arctic grayling within the Tazlina River drainage, such as those outlined by Tack (1980) for other interior Alaskan streams. From a fishery management perspective, there was a need to ascertain how Arctic grayling utilize Mendeltna Creek, whether the stock was reproductively distinct or part of a larger Tazlina stock, and when recreational angling occurs. Radiotelemetry studies

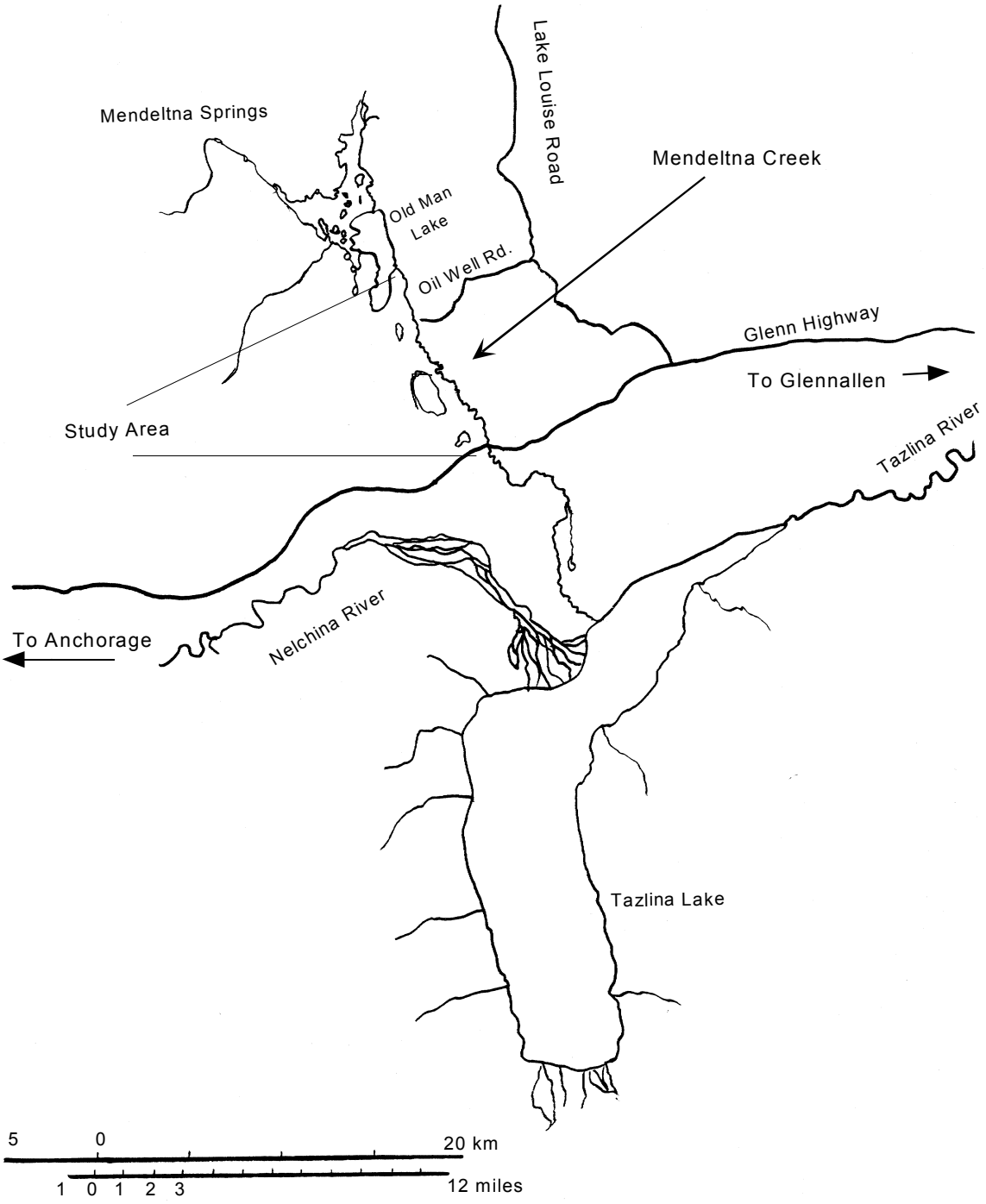
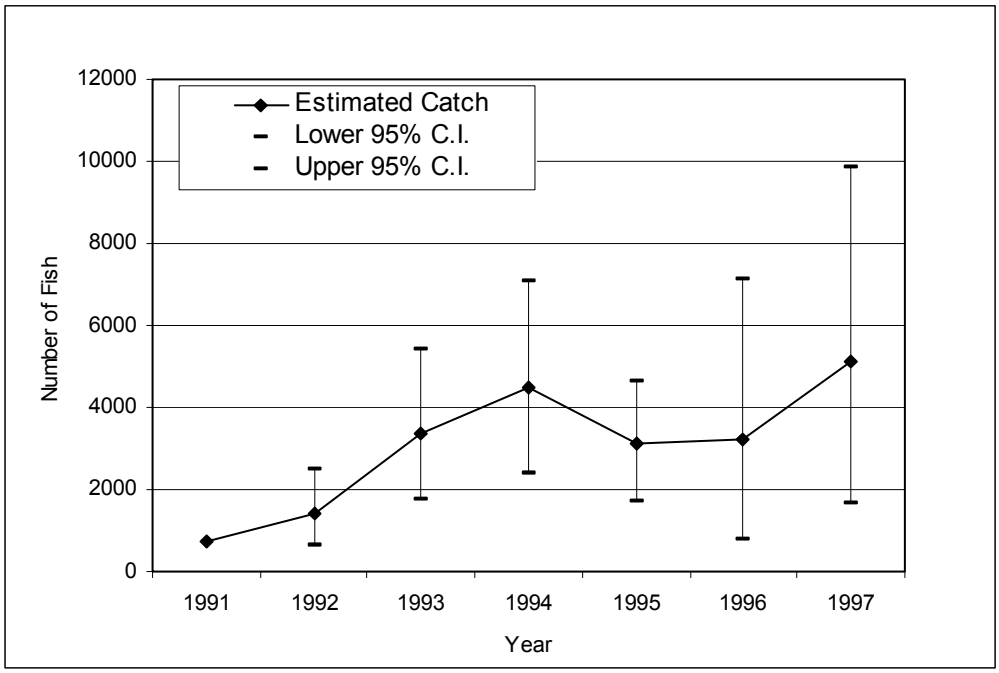


Figure 1.-Mendeltna Creek drainage and study area.

a)



b)

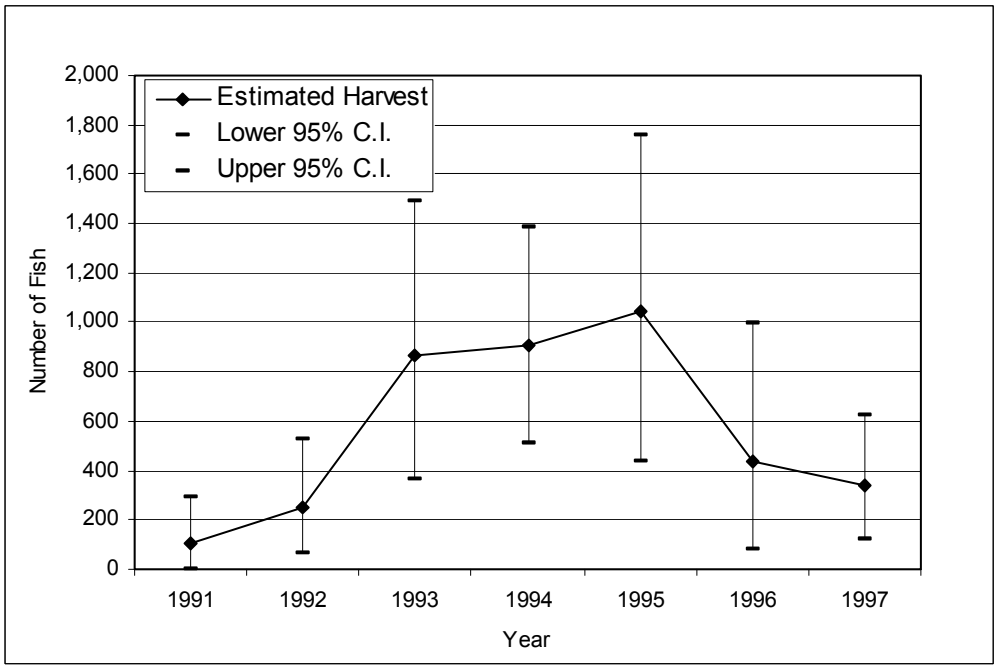


Figure 2.-Estimated catch (a) and harvest (b) of Mendeltna Creek Arctic grayling during 1991 to 1997, with 95% confidence intervals (standard error information for 1991 catch data unavailable).

were planned to begin during spring of 1998, to aid investigators in understanding Mendeltna Creek Arctic grayling. Such studies may enable investigators to discern the distribution and migration timing of these fish, and identify summer feeding, spawning and overwintering locations. Stock assessment activities, however, were initiated prior to telemetry studies, in order to better understand Arctic grayling stock composition and better plan radiotelemetry research.

The research objectives for 1998 were to:

1. estimate age and length compositions of Arctic grayling (≥150 mm FL) in a 16-19 km (10-12 mi) section of Mendeltna Creek during late May, July and August such that all proportions were within five percentage points of the true proportions 90% of the time;
2. test the hypothesis that the length compositions in late May, July and August were the same such that a difference of 10 percentage points in the proportion of Arctic grayling > 305 mm FL are the same such that a difference of 10 percentage points could be detected 90% of the time with $\alpha = 0.10$ and $\beta = 0.20$; and,
3. test the hypothesis that the age compositions in late May, July and August were the same such that a difference of 10 percentage points in the proportion of Arctic grayling of any one age are the same such that a difference of 10 percentage points could be detected 90% of the time with $\alpha = 0.10$ and $\beta = 0.20$.

In addition to the above objectives were the following tasks:

1. examine tag recoveries during July and August in order to make inferences concerning the movement of Arctic grayling in Mendeltna Creek;
2. use multiple gears during the June sampling events to determine if other gear types were more efficient at capturing fish;
3. collect CPUE data simultaneously with stock composition data in order to more clearly define the nature of effort for catch and to support the design of future assessment experiments; and,
4. document all anglers encountered during sampling trips and their distribution in the sampled area to better characterize the fishery which is largely unknown.

METHODS

Arctic grayling were sampled from Mendeltna Creek during 27-30 May, 7-9 July, and 9 August. A combination of hook-and-line and electrofishing gears was utilized during May. During July and August, fish were sampled with hook-and-line gear only.

Using one crew of three people, the stream was sampled as uniformly as possible during May, from the outlet of Old Man Lake downstream to the Glenn Highway Bridge crossing. During July, the creek was sampled in a similar manner by a crew of three people, from Oilwell Road downstream to the Glenn Highway Bridge. During August, fish were only sampled within the immediate vicinity of Oilwell Road. Investigators traveled downstream by wading and occasionally canoeing. As many Arctic grayling as possible were captured and temporarily placed in buckets. The fork length of all fish was measured to the nearest 1 mm. All fish greater than 149 mm FL were sampled for age determination (scales), tagged with a HallPrint TBA®

internal (T-bar) anchor tag, and released alive. Global positioning system (GPS) readings were recorded at each location where fish were released, to aid in the detection of fish movement between sampling occasions. Three to four scales were taken from each fish sampled for age. All scales came from an area on the fish centered approximately six scale rows above the lateral line and just posterior to the insertion of the dorsal fin (W. Ridder, Alaska Department of Fish and Game, Delta Junction, personal communication on refinement of methods described by Brown 1943). Scales were placed on gum cards in the field and retained for future processing and reading. In the laboratory, impressions of the scales were made on triacetate film using a scale press (30 s at 137,895 kPa, at a temperature of 97°C). Ages were determined by counting annuli from impressions of scales magnified to 40X with the aid of a microfiche reader. Criteria for determining the presence of an annulus were: 1) complete circuli cutting over incomplete circuli; 2) clear areas or irregularities in circuli along the anterior and posterior fields; and, 3) regions of closely spaced circuli followed by a region of widely spaced circuli (Kruse 1959). Age determination was performed at least twice for each readable set of scales, and one reader read all scales. All data pertaining to length, sampling induced mortality, tag identification numbers and colors, and recapture status were recorded on Alaska Department of Fish and Game Tagging Length Form, Version 1.0. All data mentioned above, as well as age and capture and release locations (by GPS readings) were recorded on Microsoft Excel spreadsheets (files reported in Appendix A) and electronically stored for archival.

Anglers encountered during all sampling activities were interviewed in order to learn more about fishing patterns in Mendeltna Creek.

DATA ANALYSIS

AGE COMPOSITION

Age composition of the sample was estimated as a proportion ($\hat{p}_k$) of fish in the sample at age k. The proportion of fish at age was calculated as:

$$\hat{p}_k = \frac{y_k}{n} \qquad (1)$$

where:

$\hat{p}_k$ = the proportion of Arctic grayling that were age k;

y_k = the number of Arctic grayling sampled that are age k; and

n = the total number of Arctic grayling sampled.

The unbiased variance of this proportion was estimated as:

$$\hat{V}[\hat{p}_k] = \frac{\hat{p}_k(1-\hat{p}_k)}{n-1} \qquad (2)$$

The standard error of $\hat{p}_k$ was calculated as:

$$SE[\hat{p}_k] = \sqrt{\hat{V}[\hat{p}_k]}, \qquad (3)$$

while the coefficient of variation (CV) of $\hat{p}_k$ was calculated as:

$$CV[\hat{p}_k] = \frac{SE[\hat{p}_k]}{\hat{p}_k} \qquad (4)$$

Age composition estimated during May and July were compared by chi-square contingency analysis. Since measurement error associated with the age determination process is greater with older fish (W. Ridder, Alaska Department of Fish and Game, Delta Junction, personal communication), ages ≥ 7 years old were pooled into a 7+ age group.

SIZE COMPOSITION

Size composition was estimated in a similar manner, replacing age class in equations 1 through 4 with 10 mm FL incremental size-classes, or with the RSD categories of Gabelhouse (1984). The RSD categories are: "stock" (150 to 269 mm FL); "quality" (270 to 339 mm FL); "preferred" (340 to 449 mm FL); "memorable" (450 to 559 mm FL); and, "trophy" (greater than 559 mm FL). An additional category, "substock" was created to reflect those fish <150 mm FL that were caught. Additionally, the mean length-at-age (L_k) of fish collected during 1998 was calculated as the arithmetic mean length of all fish assigned to the same age:

$$\bar{L}_k = \frac{\sum_{j=1}^{n_k} L_{jk}}{n_k} \qquad (5)$$

where:

L_{jk} = FL (mm) of fish j sampled and age k;

n_k = the number sampled for length that were age k.

The standard error (standard deviation of the sample mean) was calculated as:

$$SE = \sqrt{\frac{\sum_{j=1}^{n_k} (L_{jk} - \bar{L}_k)^2}{n_k (n_k - 1)}} \qquad (6)$$

Size compositions estimated during May and July were compared using two-sample Kolmogorov-Smirnov tests with cumulative length distribution data from each month (Conover 1980).

Both age and size composition estimates, along with tag recovery data, were used to make inferences about fish movement and changes in stock structure of Mendeltna Creek Arctic grayling between spring and summer. Individual gear types used during May were also examined for size selectivity by using two-sample Kolmogorov-Smirnov tests to examine cumulative length distributions of fish captured by gear type.

RESULTS

During late May, 75 Arctic grayling were captured by hook-and-line or electrofishing gears, during four days of sampling by three people. Only three fish captured during late May were

identified as males, from morphological features and the presence of milt; all other fish captured during late May were unsexable. In early July, investigators caught 270 Arctic grayling, during three days of angling by three people. An additional 30 Arctic grayling were sampled for length during mid-August, in the immediate vicinity of Oilwell Road. Sampling strategies of August did not match those of May nor July. Fish were not sampled during September. Instead, additional sampling activities were postponed until the next spring.

Electrofishing gear captured small fish that were not captured by hook-and-line gear. For example, the sizes of fish captured with backpack electrofishing gear during May were significantly smaller than the sizes of fish captured with hook-and-line gear during May (two-sample K-S tests, DN = 0.46, $P < 0.01$; see Figures 3 and 4). Since abundance information was lacking, there was no way to correct for biased composition estimates. Consequently, the objectives of estimating the Arctic grayling population composition were not met. Instead, age and size compositions of the catch are reported, and were compared between May, July and August.

The size composition of the fish sampled during 1998 is plotted in Figure 5 and tabulated in Tables 1 and 2. Proportions of Mendeltna Creek Arctic grayling by RSD size categories are reported in Table 3, while mean length-at-age is reported in Appendix B. Most fish captured were of the "stock" RSD category, during both May and July. The data suggested that a shift in stock composition occurred between May and July. A smaller proportion of larger-sized fish (e.g. > 275 mm FL) and greater proportion of smaller sized fish were proportionally captured during July than during May. Additionally, cumulative length distributions of fish caught during May (with hook-and-line gear alone, or in combination with electrofishing) differed significantly from those of fish caught during July (two-sample K-S tests, DN = 0.50, $P < 0.01$ for hook-and-line gear only; and DN = 0.23, $P < 0.01$ for hook-and-line and electrofishing gears combined). This indicated that a change in stock composition may have occurred between late May and early July (see Figures 6 and 7). Similarly, significant differences ($P < 0.01$) between age compositions of May and July catches were also found with Chi-square contingency analysis (Table 4). This is biologically consistent with age data collected during each month, where a change in Arctic grayling stock composition between May and July was indicated (Figure 8 and Table 5). For example, while proportions of age-3 fish captured were similar during May and July, a larger proportion of fish ≤ age-2 ($p = 0.43$, SE = 0.03) was captured during July than during May ($p = 0.13$, SE = 0.06). Conversely, fish ≥ age-4 were caught in greater proportions during May ($p = 0.35$, SE = 0.04) than during July ($p = 0.05$, SE = 0.01). Finally, length compositions of fish caught during August differed significantly from those of fish caught during both May (two-sample K-S tests, DN = 0.49, $P < 0.01$) and July (DN = 0.33, $P < 0.01$; Figures 9 and 10). This indicated that smaller fish were captured during August.

Three fish tagged during May were recaptured during July. Two recaptures moved upstream > 6.4 km between May and July, while one fish moved downstream approximately 6.4 km during the same time period. No fish tagged during May or July were recaptured during August.

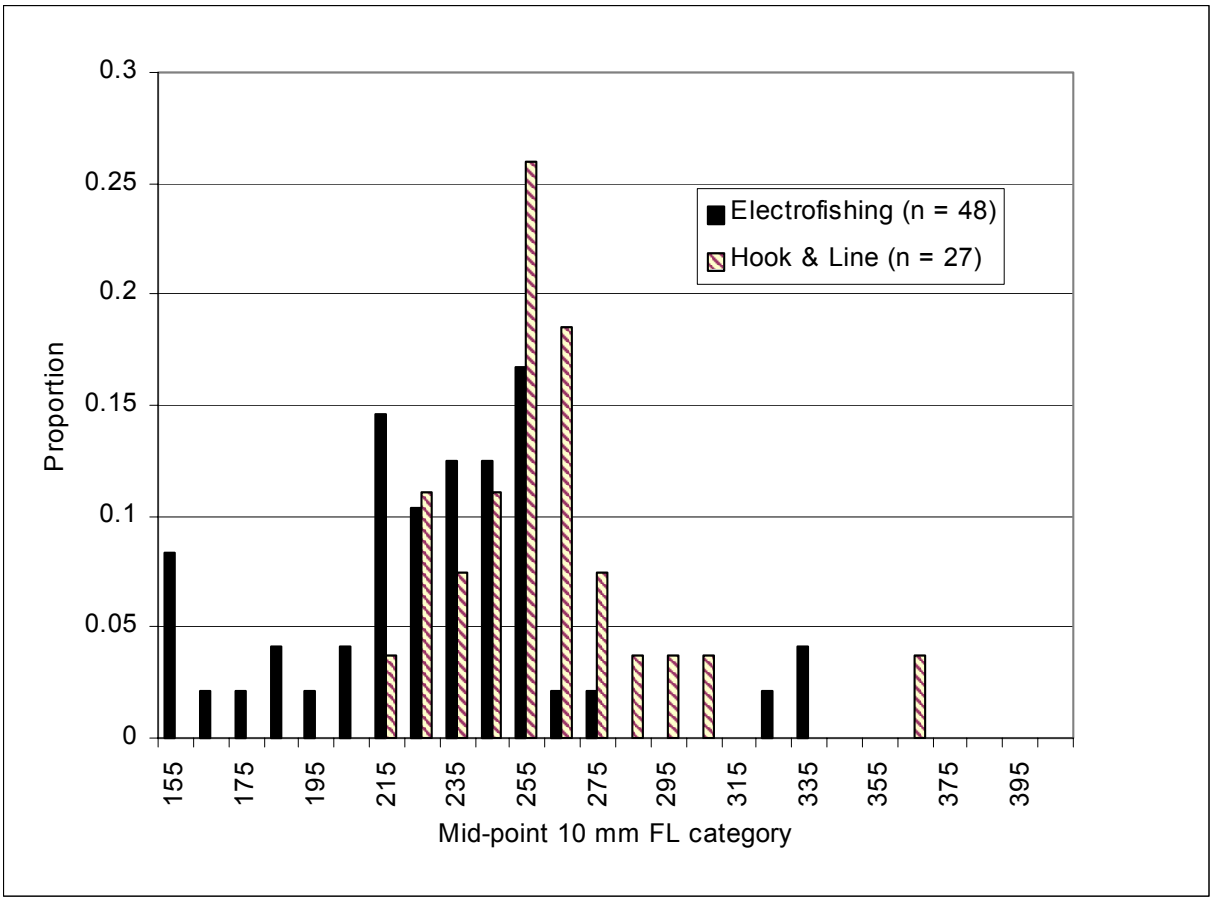


Figure 3.-Estimated proportion of Arctic grayling sampled by gear type in Mendeltna Creek during May, 1998.

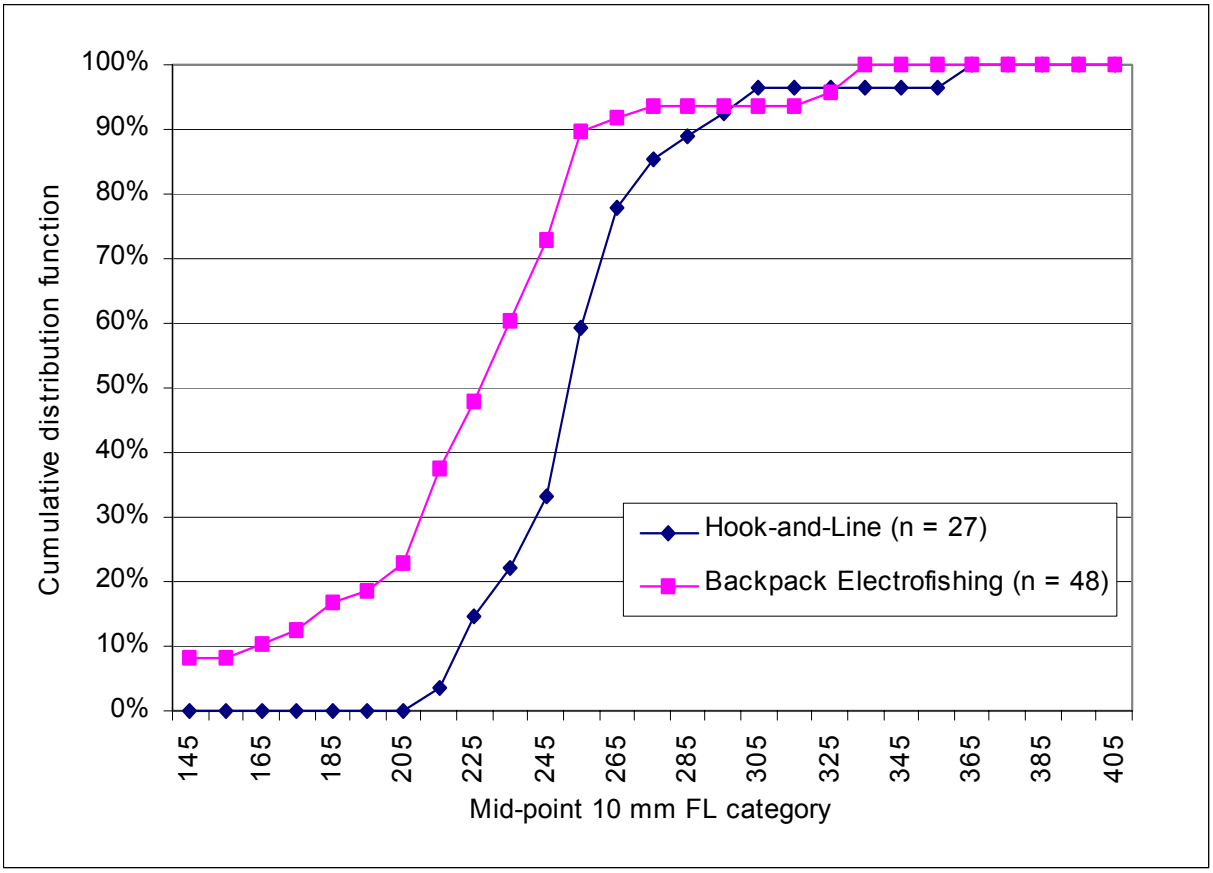


Figure 4.-Cumulative length distribution of Arctic grayling sampled by gear type during May (Two-sample K/S Tests, DN = 0.46, P < 0.01).

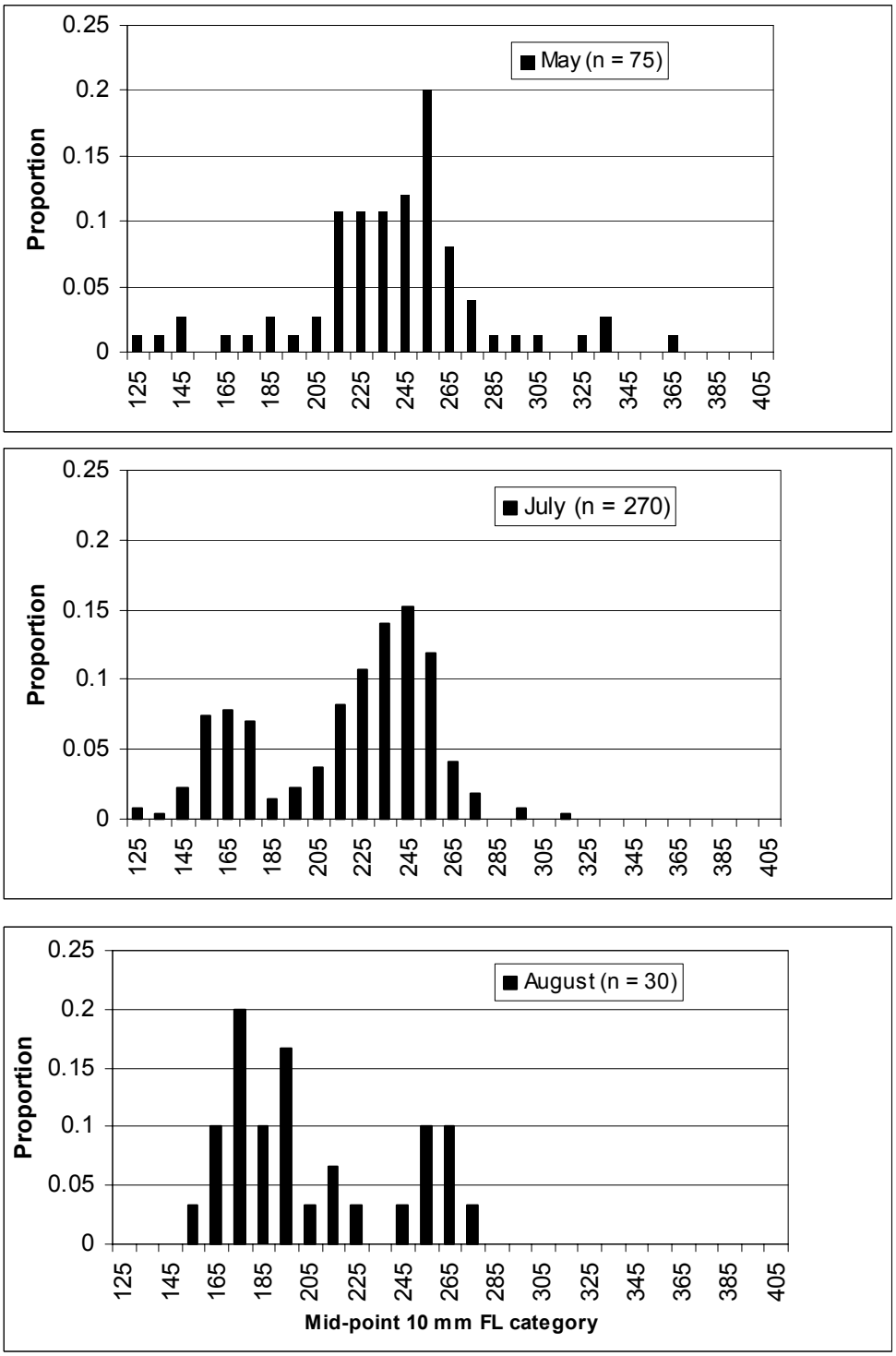


Figure 5.-Estimated proportion of Arctic grayling by 10 mm FL category sampled in Mendeltna Creek during May, July, and August, 1998.

Table 1.-Composition by size class of Arctic grayling sampled in Mendeltna Creek during May, 1998.

May				
Size Class	n	p	SE[p]	CV[p]
125	1	0.01	0.01	1.00
135	1	0.01	0.01	1.00
145	2	0.03	0.02	0.70
155	0	0.00	----	----
165	1	0.01	0.01	1.00
175	1	0.01	0.01	1.00
185	2	0.03	0.02	0.70
195	1	0.01	0.01	1.00
205	2	0.03	0.02	0.70
215	8	0.11	0.04	0.34
225	8	0.11	0.04	0.34
235	8	0.11	0.04	0.34
245	9	0.12	0.04	0.31
255	15	0.20	0.05	0.23
265	6	0.08	0.03	0.39
275	3	0.04	0.02	0.57
285	1	0.01	0.01	1.00
295	1	0.01	0.01	1.00
305	1	0.01	0.01	1.00
315	0	0.00	----	----
325	1	0.01	0.01	1.00
335	2	0.03	0.02	0.70
345	0	0.00	----	----
355	0	0.00	----	----
365	1	0.01	0.01	1.00
375	0	0.00	----	----
385	0	0.00	----	----
395	0	0.00	----	----
405	0	0.00	----	----
Totals	75	1.0		

Table 2.-Compostion by size class of Arctic grayling sampled in Mendeltna Creek during July, 1998.

July				
Size Class	n	p	SE[p]	CV[p]
125	2	0.01	0.01	0.71
135	1	0.00	0.00	1.00
145	6	0.02	0.01	0.40
155	20	0.07	0.02	0.22
165	21	0.08	0.02	0.21
175	19	0.07	0.02	0.22
185	4	0.01	0.01	0.50
195	6	0.02	0.01	0.40
205	10	0.04	0.01	0.31
215	22	0.08	0.02	0.20
225	29	0.11	0.02	0.18
235	38	0.14	0.02	0.15
245	41	0.15	0.02	0.14
255	32	0.12	0.02	0.17
265	11	0.04	0.01	0.30
275	5	0.02	0.01	0.44
285	0	0.00	----	----
295	2	0.01	0.01	0.71
305	0	0.00	----	
315	1	0.00	0.00	1.00
325	0	0.00	----	----
335	0	0.00	----	----
345	0	0.00	----	----
355	0	0.00	----	----
365	0	0.00	----	----
375	0	0.00	----	----
385	0	0.00	----	----
395	0	0.00	----	----
405	0	0.00	----	----
Totals	270	1.0		

Table 3.-Proportion by RSD category of Arctic grayling sampled in Mendeltna Creek during May and July, 1998.

	RSD Category					
May	Sub-stock	Stock	Quality	Preferred	Memorable	Trophy
n	4	61	9	1	0	0
p	0.05	0.81	0.12	0.01	0	0
SE [p]	0.03	0.05	0.04	0.01	----	----
CV [p]	0.49	0.06	0.31	1	----	----
July	Sub-stock	Stock	Quality	Preferred	Memorable	Trophy
n	15	250	5	0	0	0
p	0.06	0.93	0.02	0	0	0
SE [p]	0.01	0.02	0.01	----	----	----
CV [p]	0.25	0.02	0.44	----	----	----

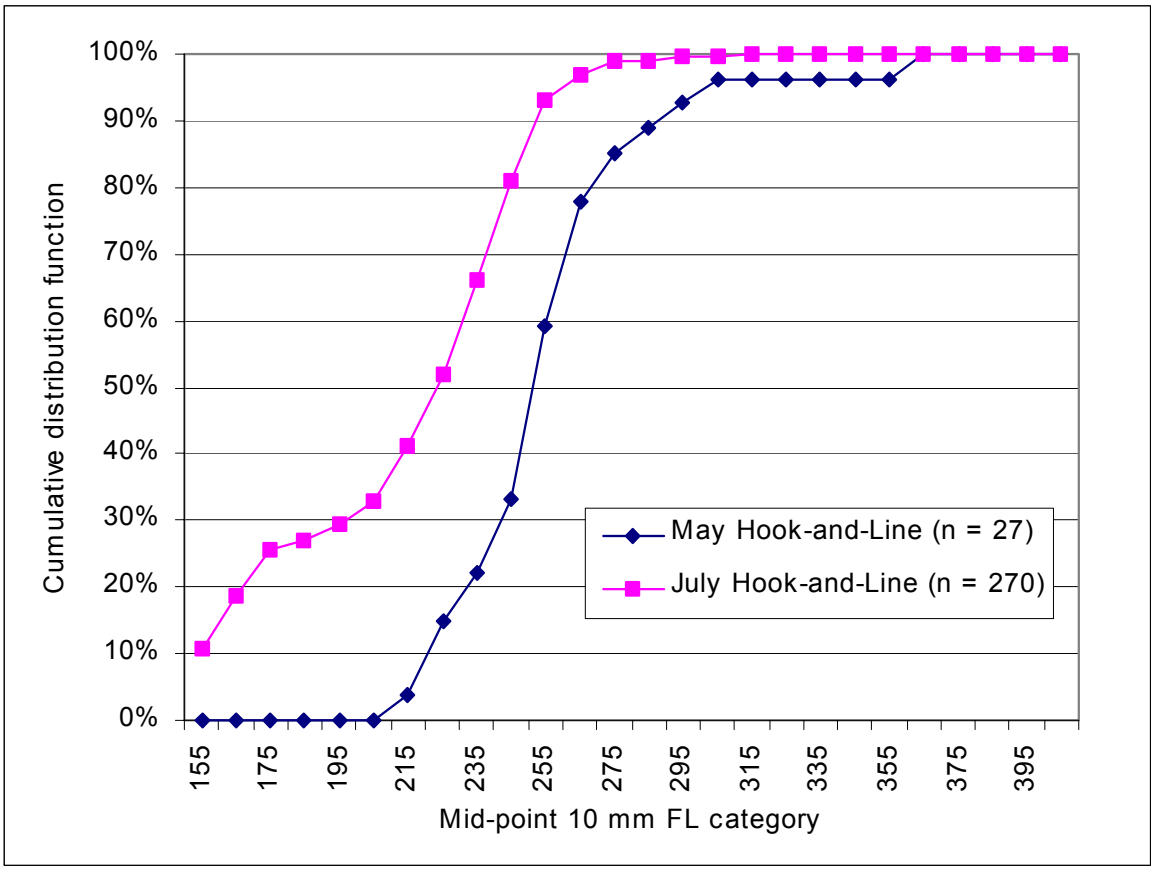


Figure 6.-Cumulative length distribution of Arctic grayling sampled by hook-and-line during May, and hook-and-line during July (two-sample K/S tests, DN = 0.50, P < 0.01).

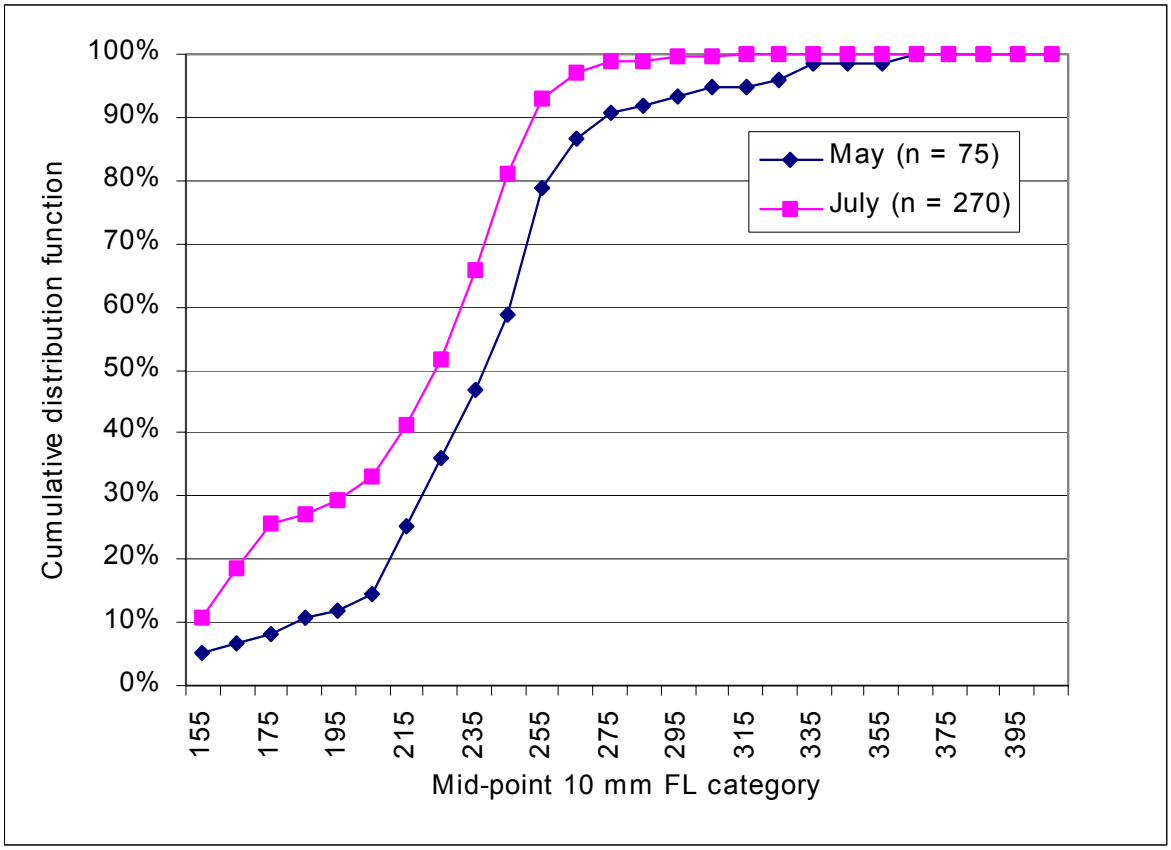


Figure 7.-Cumulative length distribution of Arctic grayling sampled by hook-and-line and backpack electrofishing during May, and hook-and-line during July (two-sample K/S tests, DN = 0.23, P < 0.01).

Table 4.-Contingency table analysis of age composition of Mendeltna Creek Arctic grayling catches during May and July, 1998 ($\chi 2 = 56.12$, df = 5, P < 0.01).

Age	1	2	3	4	5	6+
May	5	4	37	17	4	4
July	70	34	126	11	1	1

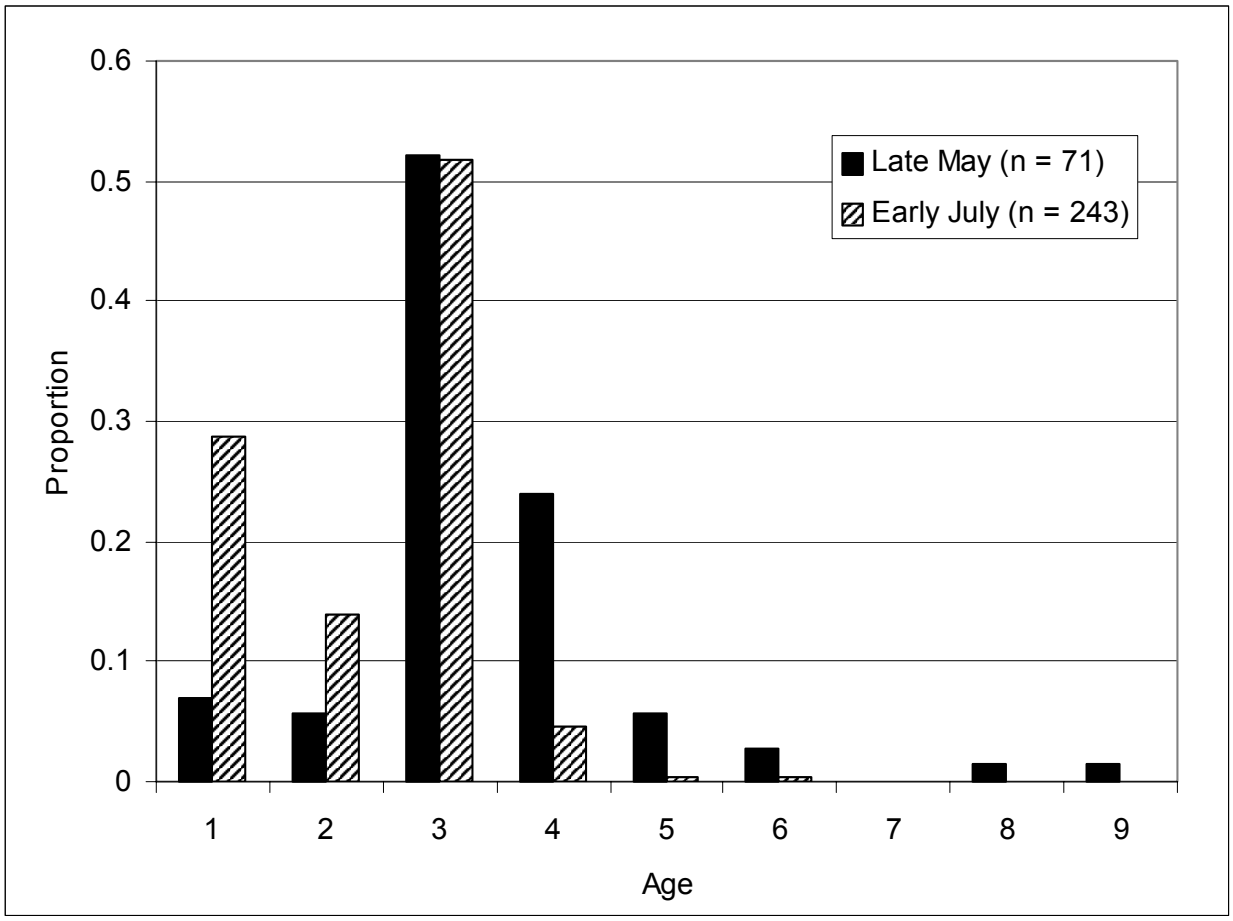


Figure 8.-Age composition of Arctic grayling sampled in Mendeltna Creek during May and July, 1998.

Table 5.-Compostion by age of Arctic grayling sampled in Mendeltna Creek during May and July, 1998.

May Age	n	p	SE[p]	CV[p]
1	5	0.07	0.03	0.43
2	4	0.06	0.03	0.49
3	37	0.52	0.06	0.11
4	17	0.24	0.05	0.21
5	4	0.06	0.03	0.49
6	2	0.03	0.02	0.70
7	0	0	----	----
8	1	0.01	0.01	1
9	1	0.01	0.01	1
Totals	71	1		

July Age	n	p	SE[p]	CV[p]
1	70	0.29	0.03	0.10
2	34	0.14	0.02	0.16
3	126	0.52	0.03	0.06
4	11	0.05	0.01	0.30
5	1	0.004	0.004	1
6	1	0.004	0.004	1
7	0	0	----	----
8	0	0	----	----
9	0	0	----	----
Totals	243	1		

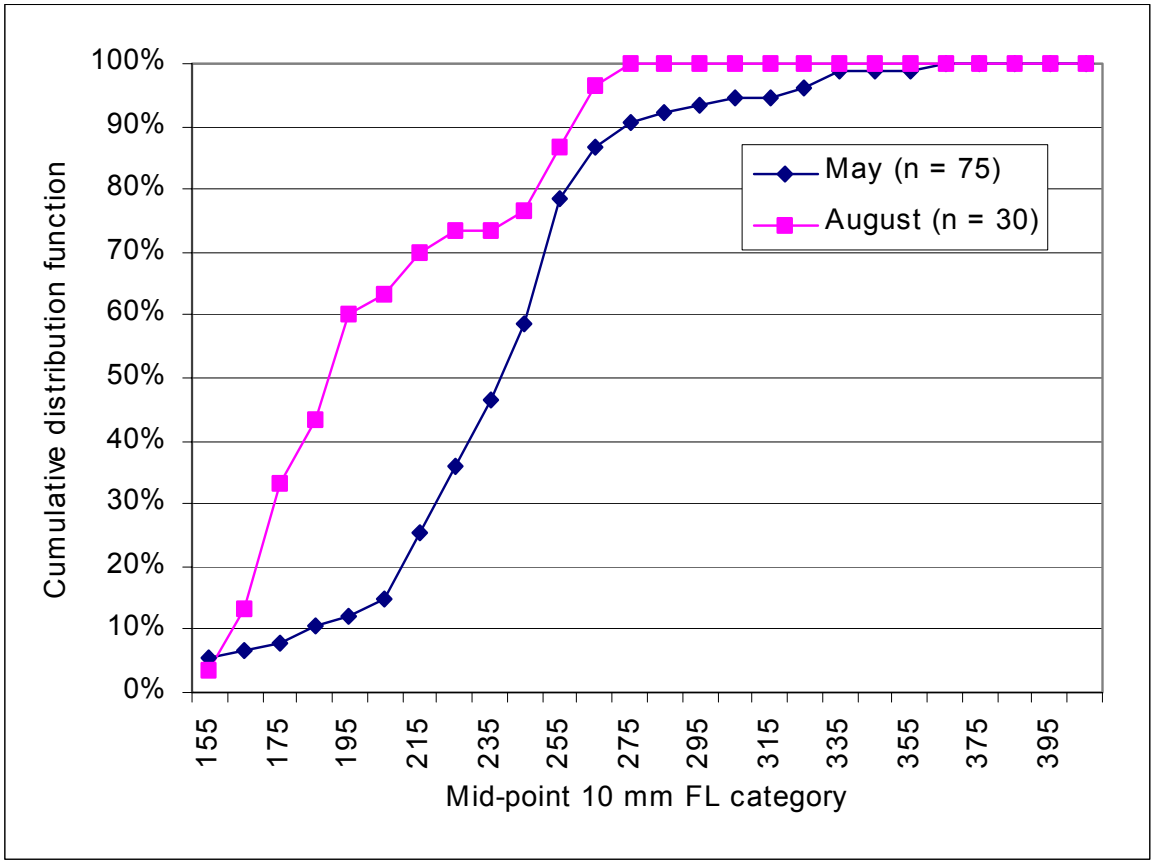


Figure 9.-Cumulative length distribution of Arctic grayling sampled by all gear types during May, and hook-and-line during August (two sample K/S tests, DN = 0.49, P< 0.01).

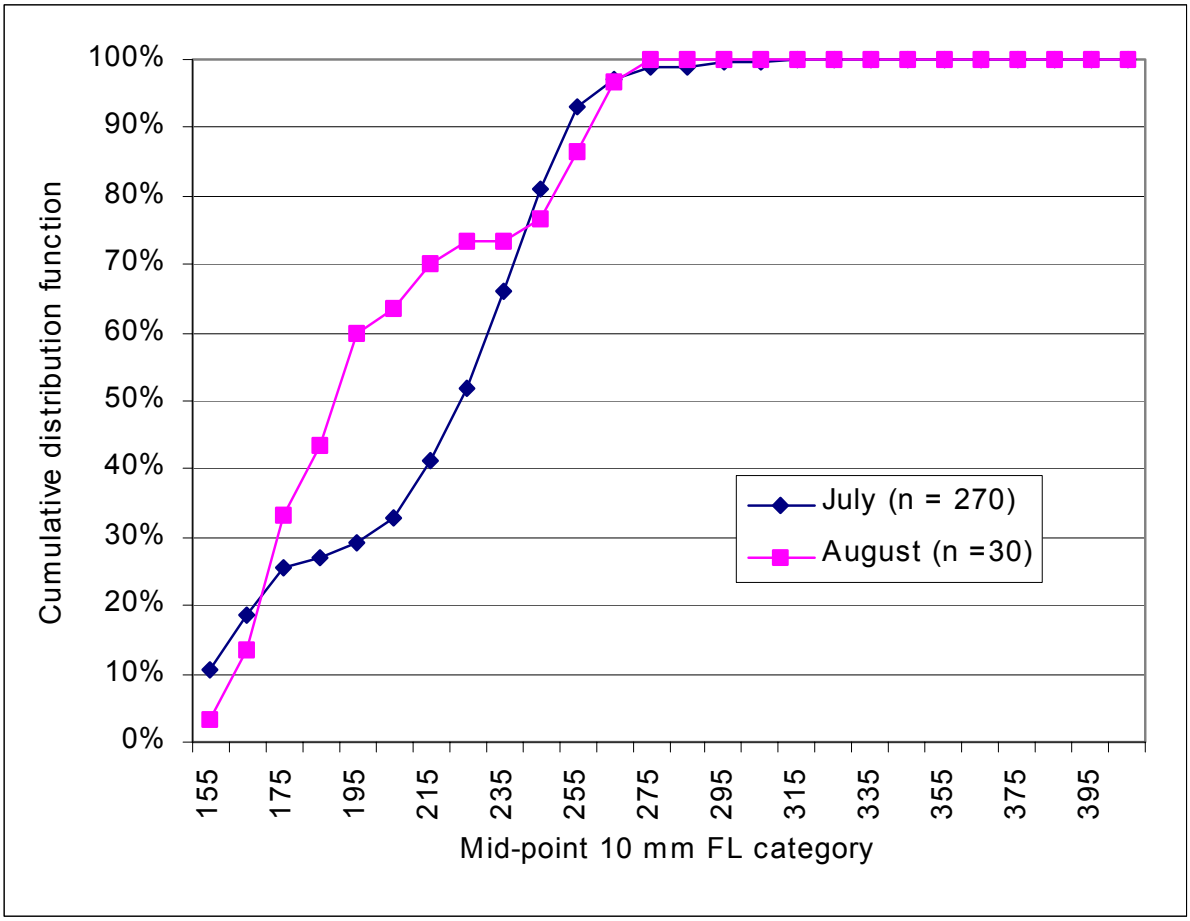


Figure 10.-Cumulative length distribution of Arctic grayling sampled during July and August (two sample K/S tests, DN = 0.33, P< 0.01).

Water temperatures ranged from 11.5°C to 14.1°C, during May sampling activities and 13.1°C to 16.2°C during July sampling activities.

Six anglers were interviewed on Mendeltna Creek during 1998 sampling activities while one angler was interviewed after returning tag information. Three anglers indicated that they fished in Mendeltna Creek beginning around Memorial Day (May 30), while all anglers indicated they fished for Arctic grayling in Mendeltna Creek at various times throughout the summer. One angler reported harvesting Arctic grayling in past years during late April and early May, many of which were over eighteen inches in length, and in spawning condition.

DISCUSSION

Mendeltna Creek was identified as supporting relatively large harvests of Arctic grayling (nearly 1,000 fish annually) during 1988, and again during 1993 through 1995. Radiotelemetry was proposed during 1998 to study the distribution and seasonal movements of Mendeltna Creek Arctic grayling, to determine if the stock is reproductively distinct, or part of a larger Tazlina stock. However, because no abundance and composition data, nor life history information was available for Mendeltna Creek Arctic grayling, baseline studies were initiated during 1998, instead. Data collected during 1998 suggests that Mendeltna Creek does not support a large summer population of Arctic grayling. It is likely that more than 270 fish would have been captured during July if the population was as large as initially expected. Arctic grayling may have been more numerous further downstream during summer, where they may have been feeding on salmon eggs. The density of chinook and sockeye salmon returning to spawn in Mendeltna Creek was greatest below the Glenn Highway Bridge during summer aerial survey flights of 1998 (T. Taube, Alaska Department of Fish and Game, Glennallen, personal communication). However, if Arctic grayling were more numerous downstream from the Glenn Highway Bridge, it is unlikely that many anglers fished the lower portions of Mendeltna Creek because of its inaccessibility. Mendeltna Creek Arctic grayling harvest estimates reported in the SWHS likely came from respondents who fished at the Oilwell Road or Glenn Highway access locations. Investigators encountered relatively few fish during spring and summer within the study area; however, fishing was not conducted during the fall. It is possible that harvests of Arctic grayling have been at the lower confidence interval limits of those estimates reported in the SWHS (Figure 2). It is also possible that trends depicted in Figure 2 are real, that Mendeltna Creek Arctic grayling harvests were extraordinarily high during the past five years and the stock suffered overexploitation. Nonetheless, there is no baseline Arctic grayling abundance, composition or habitat use data for Mendeltna Creek, nor is there any information to suggest harvest levels sustainable for this stock.

Data also indicated that a greater proportion of larger, older fish were in Mendeltna Creek during late May than during July. The data also indicated that small, sub-adult Arctic grayling (< 200 mm FL) were in Mendeltna Creek in greater proportions during July than during May. If electrofishing gear had been used during July, more smaller-sized fish would likely have been caught, and may have made the differences depicted in Figures 5 and 6 even larger. Thus, a change in population composition probably occurred between late May and early July. Large fish (possibly in spawning condition) may have been more numerous during early spring, and emigrated during late spring. Sampling activities conducted during late spring may have

coincided with the terminus of this emigration. Investigators were only able to determine the sex of three fish during late May, which indicated that Arctic grayling spawned earlier than late May. Water temperatures known to initiate Arctic grayling spawning activity (approximately 4°C; Tack 1980) probably occurred during late April to early May, whereas investigators encountered much higher water temperatures during late May. Movement data from tag recoveries is too sparse (three recaptures) to make inferences concerning Arctic grayling movements between the months of sampling. However, the lack of tag recoveries may also suggest that fish emigrated during or after May sampling activities. Alternatively, the lack of tag recoveries may suggest that the Arctic grayling population is much larger than catch data indicated. However, this suggestion is unlikely since the creek was sampled intensively during both May and July. While small, sub-adult Arctic grayling (< 200 mm FL) may have moved into Mendeltna Creek to summer feed, it is also possible that larger-sized adults (> 270 mm FL) remained in the creek between May and July, but where difficult to capture. Again, because of sampling intensity during July, this scenario seems unlikely.

Smaller-sized fish were caught in greater proportions during August than during May or July. However, fish were only sampled within the immediate vicinity of the Oilwell Road access during August, and considerably fewer fish were captured than during May or July. The data, therefore, do not necessarily suggest that a change in stock composition occurred between July and August.

Angler interviews and historical stream surveys (ADF&G, *Unpublished*) indicate that large adult Arctic grayling have been historically present in large numbers during early spring, and suggest that Arctic grayling may use Mendeltna Creek as a spawning location. Arctic grayling have also historically utilized the creek as a summer feeding location (F. Williams, Alaska Department of Fish and Game, Glennallen, personal communication). However, changes in stream habitat may have altered how Arctic grayling utilize Mendeltna Creek. For example, anecdotal evidence from one local angler suggests that stream water temperatures have increased and stream flow has decreased during the past several years. While water temperatures recorded during July (16°C) did not approach thermal tolerances of Arctic grayling (approximately 24°C; LaPerriere and Carlson 1973), such temperatures may have exceeded thermal preferences of adult Arctic grayling. Movements to avoid high water temperatures of 17° and 18°C have been documented for adult Arctic grayling in the Chatanika River and in the Tangle Lakes system (Tack 1980). It is possible that adult fish may spawn in Mendeltna Creek, and emigrate elsewhere to cooler, alternative feeding locations during the summer. Mendeltna Creek may serve as a summer rearing location for young-of-the-year (YOY) and subadult Arctic grayling. Collecting stock composition data from Arctic grayling in Mendeltna Creek shortly after ice-out during early spring may provide information to support this hypothesis, and may allow fishery managers to know when large adult fish are most vulnerable to harvest.

Anglers encountered during sampling activities indicated that a spring fishery likely does not occur on Mendeltna Creek. Rather, anglers probably target Arctic grayling primarily at the Glenn Highway Bridge crossing, and secondarily at the Oilwell Road access location, throughout the summer months. Since investigators were not present in September the status of the fishery during the fall months is unknown. A mail-out survey is planned for 1999 to ascertain which months 1996-98 SWHS respondents have fished most often for Arctic grayling in Mendeltna

Creek. Radio telemetry studies will not be pursued during 1999, since few fish large enough for transmitter implantation were caught during 1998. However, radiotelemetry studies may still be a viable method to understand life history aspects of Mendeltna Creek Arctic grayling, particularly if smaller, shorter-lived transmitters are implanted in fish. This approach may not allow investigators to track fish for a full year, but may ascertain some seasonal movement data (e.g. from summer locations to overwintering areas). Since fishery managers may entertain proposals for future Board of Fisheries meetings, for changes in bag limits for Arctic grayling in Mendeltna Creek, collecting more information concerning the biology of this Arctic grayling stock may be desired. Stock assessment activities to estimate Mendeltna Creek Arctic grayling abundance and composition during mid-summer (when most sportfishing for Arctic grayling presumably occurs) are planned for 1999. In addition, investigators will sample Mendeltna Creek Arctic grayling during early spring (late April to early May) to determine if adults spawn in the creek.

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APPENDIX A

Appendix A.-Data files regarding Arctic grayling captured in Mendeltna Creek during 1998 and archived by the Research and Technical Services of the Alaska Department of Fish and Game-Sport Fish Division.

Year	Files	Contents
1998	I-021200L011998	May and July sampling
1998	I-021200L021998	August sampling

APPENDIX B

Appendix B.-Mean length-at-age of Arctic grayling sampled in Mendeltna Creek during May and July, 1998.

May Age	Mean Length	S.E.
1	147	28.38
2	189	21.00
3	235	18.75
4	248	22.05
5	276	20.14
6	324	5.66
7	----	----
8	357	----
9	332	----

July Age	Mean Length	S.E.
1	159	13.50
2	208	14.95
3	236	13.83
4	247	15.49
5	310	----
6	287	----
7	----	----
8	----	----
9	----	----